



DECLARATION

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Saitama, SAITAMA, Japan, understand both English and Japanese,
am the translator of the English document attached, and do hereby
declare and state that the attached English document contains
an accurate translation of the official certified copy of
Japanese Patent Application No. Hei9-280717, and that all
statements made herein are true to the best of my knowledge.

Declared in Saitama, SAITAMA, Japan

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This is to certify that the annexed is a true copy of the
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【Title of the Invention】 METHOD FOR CONTROLLING CONNECTION
RELATIONSHIP BETWEEN POINTING DEVICE AND COMPUTER, POINTING
DEVICE, AND COMPUTER

【What is claimed is】

【 Claim 1 】 A method for controlling a connection
relationship between a pointing device and a computer main body
connectable with said pointing device, the method comprising:

a step in which, when said pointing device is connected to
a computer main body, a protocol is transmitted/received between
said pointing device and said computer by using an undefined
signal line out of signal lines of a connector for connecting
said pointing device to said computer main body;

a step in which, while transmitting/receiving said protocol,
one controller employed in said pointing device / said computer
main body confirms a state of another controller employed in said
computer main body / said pointing device; and

a step in which when such a confirmation is established that
both said pointing device and said computer main body are capable
of utilizing an additional function of said pointing device, an
operation condition of said computer main body is brought into
an additional function condition.

【Claim 2】 The control method according to Claim 1, further
comprising:

a step in which while a power supply of said computer main
body is turned ON and/or reset so as to bring said computer main
body into a waiting state, when said pointing device having the
additional function is connected to said computer main body under
waiting state, both said pointing device having the additional

function and said computer main body are operated in an original compatibility mode thereof;

a step in which a protocol transmission/reception operation is carried out between a controller employed in said pointing device and said other controller employed in said computer main body in order to check as to whether or not said additional function of said pointing device is usable; and

a step in which when a mode switching instruction is issued from a central control apparatus of said computer main body to said both controllers after said both controllers confirm that said additional function can be used, the operation modes of both said pointing device and said computer main body are switched into additional function modes.

【Claim 3】 A pointing device comprising:

a pointing device operating unit for producing an operation signal every time said pointing device is operated:

a compatibility function signal producing circuit for producing a signal indicative of an original compatibility function of said pointing device in response to the operation signal produced from said pointing device operating unit;

an additional function signal producing circuit for changing said operation signal produced from said pointing device operating unit into a signal indicative of an additional function to thereby produce an additional function signal;

a selector for selectively supplying any one of said compatibility function signal produced from said compatibility function signal producing circuit and said additional function signal produced from said additional function signal producing circuit to a computer main body connectable of said pointing

device; and

a controller for monitoring a protocol selector signal derived from said computer main body immediately after a power supply of said computer main body is turned ON, and for controlling said selector to selectively supply said additional function signal produced from said additional function signal producing circuit to said computer main body in such a case that said protocol selector signal satisfies a condition under which an operation mode is changed into an additional function mode where the additional function of said pointing device is executed.

【Claim 4】 A computer connectable with a pointing device, comprising:

a central control apparatus for executing an original compatibility function of said pointing device upon receipt of an original compatibility function control signal, and for executing an additional function of said pointing device upon receipt of an additional function control signal;

an additional function control circuit for entering thereinto an additional function signal transmitted through a pointing device control signal from said pointing device to thereby output said additional function control signal to the central control apparatus;

a compatibility function providing circuit for entering thereinto an original compatibility function signal transmitted through the pointing device control signal from said pointing device to thereby output said additional function control signal to the central control apparatus;

a selector for selectively supplying said pointing device

control signal derived from said pointing device to said compatibility function providing circuit and said additional function control circuit; and

a controller for controlling a protocol selector signal transmitted/received between said own controller and said pointing device in response to an instruction issued from said central control apparatus, and for transferring the controlled protocol selector signal to said central control apparatus and also for controlling said selector based upon said controlled protocol selector signal.

【Claim 5】 The computer connectable with a pointing device according to Claim 4 wherein:

said controller controls said selector when a power supply of said computer is turned ON in such a manner that said selector outputs said pointing device control signal to said compatibility function providing circuit, whereby said pointing device is operated in an original compatibility function mode;

when said protocol selector signal is changed and thereafter said controller confirms that said additional function of said pointing device is usable, said controller notifies said confirmation to said central control apparatus; and

when an operation mode switching instruction is issued from said central control apparatus, said controller switches the operation mode of said pointing device into said additional function mode by controlling said selector in response to said protocol selector signal.

【Detailed Description of the Invention】

【0001】

【Technical Field to which the Invention belongs】

The present invention relates to a pointing device.

【0002】

【Prior Art】

There has been proposed a mouse input system that has such additional functions capable of entering various input data indicative of characters, symbols, and functions in response to cursor positions on the display screen in addition to the original function as the mouse (Japanese Patent Laid-open Publication No. Hei3-98109.).

【0003】

【Problem to be solved by the Invention】

Precisely speaking, as to the typical conventional pointing device, when the position of this pointing device is moved, the pulse signals are produced in response to the move amount thereof. The switches of the pointing device directly transfer the pulse signals to a main body of a personal computer. As a consequence, the structure itself of this typical pointing device is made very simple. However, when the mouse input system proposed in the above-described Japanese Patent Laid-open Publication No. Hei3-98109 is used as the above-explained typical pointing device, signal lines and connectors must be newly defined between this new mouse system and the main body of the personal computer.

【0004】

Also, when such a new connector is introduced, since the conventional pointing device cannot be connected to the main body of the personal computer, there occurs a problem that the compatibility between this new mouse input system and the

conventional pointing device can be hardly secured.

【0005】

In view of the above, it is an object of the present invention to provide a method for controlling connection relationship between a pointing device and a computer which is capable of connecting a pointing device having a new function to a main body of a personal computer, without defining additional signal lines and connectors between the pointing device and the main body of the personal computer, and also being capable of using another pointing device not having a new function, and to provide a pointing device and a computer using the same.

【0006】

【Means for solving problem】

In order to solve the above problem, the present invention, which relates to a method for controlling a connection relationship between a pointing device and a computer main body connectable with the pointing device, is characterized by including:

a step in which, when the pointing device is connected to a computer main body, a protocol is transmitted/received between the pointing device and the computer by using an undefined signal line out of signal lines of a connector for connecting the pointing device to the computer main body;

a step in which, while transmitting/receiving the protocol, one controller employed in the pointing device / the computer main body confirms a state of another controller employed in the computer main body / the pointing device; and

a step in which when such a confirmation is established that both the pointing device and the computer main body are capable

of utilizing an additional function of the pointing device, an operation condition of the computer main body is brought into an additional function condition.

【0007】

Accordingly, it become possible to connect a pointing device having a new function to a main body of a personal computer, without defining additional signal lines and connectors between the pointing device and the main body of the personal computer.

【0008】

The present invention, which relates to a pointing device, is characterized by including:

a pointing device operating unit for producing an operation signal every time the pointing device is operated;

a compatibility function signal producing circuit for producing a signal indicative of an original compatibility function of the pointing device in response to the operation signal produced from the pointing device operating unit;

an additional function signal producing circuit for changing the operation signal produced from the pointing device operating unit into a signal indicative of an additional function to thereby produce an additional function signal;

a selector for selectively supplying any one of the compatibility function signal produced from the compatibility function signal producing circuit and the additional function signal produced from the additional function signal producing circuit to a computer main body connectable of the pointing device; and

a controller for monitoring a protocol selector signal derived from the computer main body immediately after a power

supply of the computer main body is turned ON, and for controlling the selector to selectively supply the additional function signal produced from the additional function signal producing circuit to the computer main body in such a case that the protocol selector signal satisfies a condition under which an operation mode is changed into an additional function mode where the additional function of the pointing device is executed.

【0009】

The present invention, which relates to a computer connectable with a pointing device, is characterized by including:

a central control apparatus for executing an original compatibility function of the pointing device upon receipt of an original compatibility function control signal, and for executing an additional function of the pointing device upon receipt of an additional function control signal;

an additional function control circuit for entering thereinto an additional function signal transmitted through a pointing device control signal from the pointing device to thereby output the additional function control signal to the central control apparatus;

a compatibility function providing circuit for entering thereinto an original compatibility function signal transmitted through the pointing device control signal from the pointing device to thereby output the additional function control signal to the central control apparatus;

a selector for selectively supplying the pointing device control signal derived from the pointing device to the compatibility function providing circuit and the additional

function control circuit; and

a controller for controlling a protocol selector signal transmitted/received between the own controller and the pointing device in response to an instruction issued from the central control apparatus, and for transferring the controlled protocol selector signal to the central control apparatus and also for controlling the selector based upon the controlled protocol selector signal.

【0010】

Accordingly, it is possible to connect another pointing device not having a new function to a main body of a computer.

【0011】

【Modes for carrying out the Invention】

Hereinafter, embodiments of the present invention will be described with reference to the accompanying drawings.

【0012】

Referring now to Fig. 1, a pointing device 1 according to one embodiment of the present invention includes a pointing device operating unit 3, a new function signal producing circuit 4, a compatibility function signal producing circuit 5, a selector 6, and a controller 7. Also, the personal computer (PC) main body 2 is equipped with a pointing device signal analyzing unit which is made up of a controller 11, a selector 12, a new function control circuit 13, a compatibility function providing circuit 14, and a central control apparatus 15.

【0013】

The pointing device operating unit 3 sends a signal to the new function signal generating circuit 4 and the compatibility function signal generating circuit 5 every time the pointing

device 1 is operated.

【0014】

The new function signal producing circuit 4 receives the signal and converts this signal into another signal having a signal format fitted to the new function control format, and then transmits this converted signal to the selector 6. In the case that this new function signal producing circuit 4 receives a signal (for example, printing data produced in response to a move amount of the pointing device 1, a signal for indicating a change in a sensitivity of the pointing device, a signal for indicating that a supply of information is temporarily stopped, and so on) via the selector 6 from the personal computer main body 2, the new functions signal producing circuit 4 executes an analyzing process operation for this signal to acquire a command and data. Upon receipt of the signal supplied from the pointing device operating unit 3, the compatibility function signal producing circuit 5 produces a signal (a conventional bus mouse type of signal, hereinafter referred to as a compatibility signal) fitted to the compatibility, and then transmits this produced signal to the selector 6.

【0015】

The controller 7 monitors a protocol selector signal 9 immediately after a power supply is turned ON, and sends a signal to the selector 6 in such a case that the protocol selector signal 9 can satisfy a condition used to change the operation mode into a new function mode in which the new function of the pointing device 1 is executed. Upon receipt of the signal sent from the controller 7, the selector 6 connects an output signal derived from either the compatibility function signal producing circuit

5 or the new function signal producing circuit 4 to a pointing device control signal 10. A power supply/ground signal 8 is employed as to apply a reference power supply voltage and a ground potential from the personal computer main body 2 to the pointing device 1. The protocol selector signal 9 is transferred between the controller 7 and the controller 11. In an apparatus and a pointing device, which can produce only the compatibility signal, this protocol selector signal 9 is communicated by employing a signal pin defined as NC (Not Connected). It should be understood that the pointing device control signals 10 are relayed through a plurality of signal lines connected between the selector 6 of the pointing device 1 and the selector 12 of the PC main body 2.

【0016】

The controller 11 receives an instruction issued from the central control apparatus 15 to thereby control the protocol selector signal 9. Then, this controller 11 transfers the controlled result to the central control apparatus 15 and also controls the selector 12. In other words,

- (1) The controller 11 continuously monitors the protocol selector signal 9.
- (2) The controller 11 sends out a signal with a specific timing (switching this signal to free or OV).
- (3) The controller 11 monitors as to whether or not the protocol selector signal 9 is changed at expected timing.
- (4) If the protocol selector signal 9 is changed at the expected timing, then the controller 11 notifies such a fact that the expected pointing device is connected to the central control apparatus 15. When a request is made from the central control

apparatus 15 to change the operation mode into the new function mode, the controller 11 again notifies the changed result of the protocol selector signal 9 to the central control apparatus 15.

【0017】

In response to an instruction issued from the controller 11, the selector 12 connects the pointing device control signal 10 to either the new function control circuit 13 or the compatibility function providing circuit 14. The compatibility function providing circuit 14 directly receives the signal 10 supplied from the selector 12 and then transfers this received signal 10 to the central control apparatus 15. Alternatively, the compatibility function providing circuit 14 receives the signal supplied from the new function control circuit 13 to convert this received signal into such an element convertible into the compatibility function (namely, a signal used in the compatibility function, concretely speaking, counter information, and right button information and left button information). Then, the compatibility function control circuit 14 transfers the converted element to the central control apparatus 15. In the new function control circuit 13, a signal is transferred to the compatibility function providing circuit 14 and another signal is transferred to the central control apparatus 15.

【0018】

Operations of the embodiment according to the present invention will now be explained with reference to the accompanying drawings.

【0019】

(1) First, a description will now be made of such operations

when the pointing device equipped with the new function is connected to the new-function-installed computer.

【0020】

When the power supply of the personal computer main body 2 is turned ON, all of the modules are initialized in response to a reset signal (not shown). When the initialization is performed, the controller 11 commences a process operation in accordance with the flow chart shown in Fig. 5. The controller 11 issues an instruction to the selector 12 to once switch the operation mode into the compatibility mode at a step 123 after the overall system waits for such a condition that the power supply voltage becomes stable at a step 122. Upon receipt of this instruction, the selector 12 selects the internal circuit in such a manner that the pointing device control signal 10 is connected to the compatibility function providing circuit 14.

【0021】

At a further step 124, the level of the protocol selector signal 9 is held at a high level H. Both the controller 11 provided on the PC main body side and the controller 7 provided on the pointing device side are capable of performing Nch-open drain control. As indicated in Fig. 3, since the protocol selector signal 9 is connected via a resistor to the power supply on the side of the personal computer main body 2, the level of the protocol selector signal 9 is a high level, as indicated in a time instant t1 of the timing chart shown in Fig. 2. When the electric power is supplied via the power supply signal 8 to the pointing device 1 under this condition, this pointing device 1 commences the operation. After the internal data (namely, internal information required to operate microprocessor) of the

pointing device 1 has been initialized, the operation of the controller 7 is commenced. The controller 7 is brought into a waiting state until the power supply voltage becomes stable at a step 102.

【0022】

At a step 103, the controller issued an instruction to the selector 6 to switch the operation mode into the compatibility mode. Upon receipt of this instruction, the selector 6 causes the signal derived from the compatibility function signal generating circuit 5 to pass through this selector 6 and to be transferred to the pointing device control signal 10.

【0023】

Under this condition, the signal produced from the pointing device operating unit 3 is supplied to the new function signal producing circuit 4 and the compatibility function signal producing circuit 5.

【0024】

A signal capable of supporting a new function is produced by the new function signal producing circuit 4, and then this new-function supporting signal is sent to the selector 6.

【0025】

As the signal capable of supporting the new function, the below-mentioned signals are conceivable:

【0026】

MD: mouse data signal (Nch-open drain);

data is sent out in synchronism with an MC signal, and is changed by the pointing device 1.

【0027】

MC: mouse clock signal (Nch-open drain);
 set of mouse data $H \rightarrow L \rightarrow H$ (being changed by pointing device 1),
 refusal of data acceptance $H \rightarrow L$ (being changed by CPU side),
 allowance of data acceptance $L \rightarrow H$ (being changed by CPU side)

【0028】

CD: CPU data signal (Nch-open drain);
 since data is sent out in synchronism with a CC signal, this CPU data signal is changed by PC side.

【0029】

CC: CPU clock signal (Nch-open drain);
 set of mouse data $H \rightarrow L \rightarrow H$ (being changed by PC side),
 refusal of data acceptance $H \rightarrow L$ (being changed by pointing device side)
 allowance of data acceptance $L \rightarrow H$ (being changed by pointing device side)

【0030】

Similarly, a compatibility signal is produced by the compatibility function signal producing circuit 5, and then this compatibility signal is sent to the selector 6. The selector 6 receives both the signal capable of realizing the new function and the signal capable of realizing the compatibility function. Since the compatibility function signal producing circuit 5 is being connected to the pointing device control signal 10, the compatibility signal is notified to the selector 12 provided on the side of the PC main body 2. This selector 12 of the PC main body side can send the signal to the compatibility function

provided circuit 14, and can provide the compatibility function to the central control apparatus 15.

【0031】

Next, the controller 7 changes the signal level of the protocol selector signal 9 into a low level at a step 104. As a result, the low-leveled signal is transferred to the controller 11 provided on the side of the personal computer main body 2. At a step 125, this controller 11 provided on the side of the personal computer main body 2 confirms that the value of the protocol selector signal 9 becomes a low level. At a step 126, the controller 11 is brought into a waiting state until the signal level of the protocol selector signal becomes a high level. At a step 105, the controller 7 provided on the side of the pointing device 1 confirms that the signal level of the protocol selector signal 9 is changed into a low level. In the case that the signal level of the protocol selector signal 9 is not changed into the low level, the pointing device 1 is set in such a manner that this pointing device 1 is operated in the compatibility mode (step 113), and then the process operation is accomplished. Conversely, when the signal level of the protocol selector signal 9 is changed into the low level, the protocol selector signal is under such a state shown in a time instant t2 of Fig. 2. At a step 106, the controller is brought into a waiting state for a predetermined time period. At a further step 107, the signal level of the protocol selector signal 9 is set to a high level. The high-leveled protocol selector signal 9 is under such a state shown in a time instant t3 of Fig. 2.

【0032】

The controller 7 provided on the side of the pointing device

1 confirms at a step 108 that a value of a protocol selector (that is, directly or the protocol selector signal 9) has been changed to the high level. If this signal value of the protocol selector signal 9 has not yet been changed to the high level, then the pointing device 1 is operated in the compatibility mode. Conversely, when the signal level of this protocol selector signal 9 has been changed to the high level, the controller 7 provided on the side of the pointing device 1 is brought into a waiting state until the signal value of the protocol selector signal 9 becomes a low level at a step 109. On the other hand, when the controller 11 provided on the side of the central control apparatus 15, in a step 126, has confirmed that the signal level of the protocol selector signal 9 has become at a high level, the controller 11 notifies the central control apparatus 15 that the pointing device 1 can support the new function, and then the controller 11 is brought into a waiting state until the controller 11 receive a signal being used to command the controller 11 to issue new instructions from the central control apparatus 15 in a step 127. That is, when the controller 11 receives a command signal that commands the controller 11 to support the new function from the central control apparatus 15, the central control apparatus 15 sets the signal level of this protocol selector signal 9 to a low level at a step 128, and then commences transfer preparation so as to be operable in a new function mode at a step 129.

【0033】

When the transfer preparation is notified to the selector 12, the selector 12 separates the pointing device control signal 10 from the compatibility function providing circuit 14 and the

new function control circuit 13 in order to protect the compatibility function providing circuit 14 and the new function control circuit 13. Thereafter, the selector 12 is brought into a waiting state for a predetermined time period at a step 130. The reason is given as follows. Since the format of the signal on the lower digit side is changed, there are certain possibilities that noise is mixed with the signal, resulting in error operations, or the circuit is destroyed because the data collide with each other.

【0034】

On the other hand, the controller 7 provided on the side of the pointing device 1 senses that the signal level of the protocol selector signal 9 becomes a low level at a step 109. At the next step 110, in order to prepare transferring of the present mode into the new function mode, the pointing device operating unit 3 sends a signal to the compatibility function signal producing circuit 5, the new function signal producing circuit 4, and the selector 6. The selector 6 cuts a signal/circuit relationship between the new function signal producing circuit 4 and the pointing device control signal 10. The controller 7 changes the signal level of the protocol selector signal 9 into a low level at a step 111. At a step 112, the controller 7 instructs that the connection is changed by the selector 6 so as to be transferred to the new function mode. The selector 9 selects the circuit arrangement that the signal produced from the new function signal producing circuit 4 may flow into the pointing device control signal 10. Upon receipt of an instruction issued from the controller 7, the compatibility function signal producing circuit 5 stops its operation. Upon

receipt of an instruction issued from the controller 7, the new function signal producing circuit 4 is initialized by itself and commences the operation thereof. On the other hand, the controller 11 is brought into a waiting state for a preselected time period (namely, until pointing device 1 is again initialized) at a step 130, and then sets the signal level of the protocol selector signal 9 at a further step 131. Under this condition, if the pointing device 1 is again initialized under normal condition, since the protocol selector signal 9 is brought into such a state defined at a time instant "t5" of Fig. 2, then it is so judged at a step 132 that the signal level thereof is a low level. Since the PC main body 2 is operated at a step 133, the controller 11 issues an instruction to the selector 12. The selector 12 selects the circuit connection in such a manner that the pointing device control signal 10 may be transferred to the new function control circuit 13. Under this condition, if the pointing device 1 is operated, then a signal is sent to the new function signal producing circuit 4, so that a signal corresponding to the new function is produced. This signal is transferred to the selector 6, and thereafter is supplied via the pointing device control signal 10 to the selector 12. Since the selector 12 is set in such a manner that the signal is sent to the new function control circuit 13, this signal is sent to the new function control circuit 13. Then, the new function control circuit 13 notifies this signal to the central control apparatus 15, so that the new function can be employed.

【0035】

Also, the signal of the new function control circuit 13 is converted, and the converted signal is transferred to the

compatibility function providing circuit 14. As a result, the compatibility signal may also be transferred to the central control apparatus 15, and the compatibility can be maintained.

【0036】

The controller 11 provided on the side of the PC main body 2 is brought into a waiting state until the signal level of the protocol selector signal 9 becomes a low level at a step 134. When the pointing device 1 is cut out under this condition, since there is no factor capable of lowering the signal level of the protocol selector signal 9 to the low level, the signal level becomes a high level as represented as a state of a time instant "t7" in Fig. 2. As a consequence, the process operation by the controller 11 provided on the side of the PC main body 2 is returned to the routine of step 123. At this step 123, this controller 11 is brought into a waiting state until the pointing device 1 is newly connected to the PC main body 2.

【0037】

(2) Next, a description will now be made of operations executed in such a case that a conventional type pointing device equipped with no new function is connected to the PC main body 2 capable of receiving the new function.

【0038】

It is so designed that since the conventional type pointing device is not equipped with the above-explained new function signal producing circuit 4, controller 7, and selector 6, the signal of the pointing device operating unit 3 is directly transferred to the pointing device control signal 10. The protocol selector signal 9 is not connected to the PC main body 2. As a result, the signal derived from the pointing device

operating unit 3 is transferred through the compatibility function signal producing circuit 5 to the PC main body 2.

【0039】

When the power supply of the PC main body 2 is turned ON, the process operation thereof is commenced. Since the value of the protocol selector cannot be changed into a low level, the value of the protocol selector is not changed into the low level at a step 125, but the process operation of the controller 11 is entered into an infinite loop. As a result, since the operation mode of the PC main body 2 cannot be transferred to the new function mode, the selector 12 causes data to flow through the compatibility function providing circuit 14, and then provides the compatibility function to the central control apparatus 15, so that no new function is provided.

【0040】

(3) Next, a description will now be made of such operation executed when the pointing device equipped with the new function is connected to such a PC (personal computer) which cannot interpret the new function.

【0041】

While the PC main body is not equipped with the controller 11, the selector 12, and the new function control circuit 13, the pointing device control signal 10 is directly supplied via the compatibility function providing circuit 14 to the central control apparatus 15.

【0042】

Also, the protocol selector signal 9 is brought into such an NC condition that this protocol selector signal 9 is connected to the PC main body 2. When the pointing device 1 equipped with

the new function is connected to this PC main body 2 under this condition, this pointing device 1 executes the initializing operation, and commences its operation in the compatibility mode.

【0043】

On the other hand, the controller 7 of this pointing device 1 is executed up to the step 107, so that this controller 7 tries to change the signal level of the protocol selector signal 9 into a high level. Since there is no pull-up portion in Vcc of Fig. 3, this protocol selector signal 9 cannot become such a high level. As a result, the protocol selector signal 9 is branched to a low level at the step 108. Then, this pointing device can be secured that this pointing device is operated in the compatibility mode at a step 113.

【0044】

It should be noted that although this embodiment has described the pointing device, other electronic devices such as a printer, a disk drive, and a keyboard may be operated in the plural modes by employing a similar algorithm if these electronic devices are connected via an interface having a non-connected signal line in the conventional compatibility mode to the PC main body. For example, a keyboard is operable in response to only a present key signal and a small number of control commands. Alternatively, this keyboard may be used as a composite device (namely, a combination of mouse and keyboard), while using this inventive technique. Also, a printer supplies a large amount of data to one side, in response to a control signal, using 8 data pins. While using this inventive technique, a FAX control signal may be assembled.

【0045】

In such a case that the pointing device equipped with the new function is used only with the PC main body equipped with the new function, the compatibility function signal producing circuit 5 is no longer required on the side of this pointing device. As a result, the pointing device cannot provide the compatibility function. However, when the machine is initiated, since the operation mode of the PC main body is switched to the new function control mode, both the new function realized by the new function circuit 13 and the compatibility function realized by the compatibility function providing circuit 14 can be provided. As a consequence, there is another effect that the circuit components for providing the compatibility function of the pointing device is not required.

【0046】

【Effect of the Invention】

As previously described, the present invention owns the following effects.

【0047】

1) That is, the PC main body can provide the conventional compatibility function of the pointing device. The reason is given as follows: The compatibility function providing circuit is equipped in the PC main body, and both the PC main body and the pointing device are operated in the compatibility function until the signal is switched by the protocol selector.

【0048】

2) Only when both the pointing device and the PC main body can support the new function, the operation mode can be transferred to the new function mode. The reason is given as follows: When only one of these devices supports the new function,

the switching control of the protocol selector signal cannot be carried out under normal condition.

【0049】

3) Even when the protocol selector signal cannot be switched, the device can be operated in the conventional compatibility function. The reason is given as follows: Until both devices start to select the protocol selector signal, these devices are operated in the compatibility mode.

【Brief Description of the Drawings】

【Fig. 1】

Figure 1 is a schematic block diagram for representing a pointing device and a pointing device signal analyzing unit of a personal computer, according to an embodiment of the present invention.

【Fig. 2】

Figure 2 is a timing chart for representing a change in a protocol selector signal 9 of the pointing device according to the embodiment.

【Fig. 3】

Figure 3 is a circuit diagram for illustratively showing a connecting example of a protocol selector signal line of the pointing device.

【Fig. 4】

Figure 4 is a flow chart for describing process operation of a controller 7 employed in the pointing device.

【Fig. 5】

Figure 5 is a flow chart for describing process operation of a controller 11 employed in the computer.

【Explanation of Characters】

- 3 pointing device operating unit
- 4 new function signal producing circuit
- 5 compatibility function signal producing circuit
- 6 selector
- 7 pointing device controller
- 8 power supply/ground signal
- 9 protocol selector signal
- 10 pointing device control signal
- 11 pointing device controller
- 12 selector
- 13 new function control circuit
- 14 compatibility function providing circuit
- 15 central control apparatus
- t1 at a time during pointing device connection
- t2 at a time of commencing of pointing device
initialization
- t3 at a time of completing of pointing device
initialization
- t4 at a time of commencing of protocol control
- t5 at a time of completing of protocol control
- t6 at a time of commencing of pointing device
disconnection
- t7 at a time of completing of pointing device
disconnection

【Title of the Document】 Abstract

【Abstract】

【Problem】 Connecting a pointing device having a new function to a main body of a personal computer, without defining additional signal lines and connectors between the pointing device and the main body of the personal computer, and also Connecting another pointing device not having a new function to the main body of the personal computer.

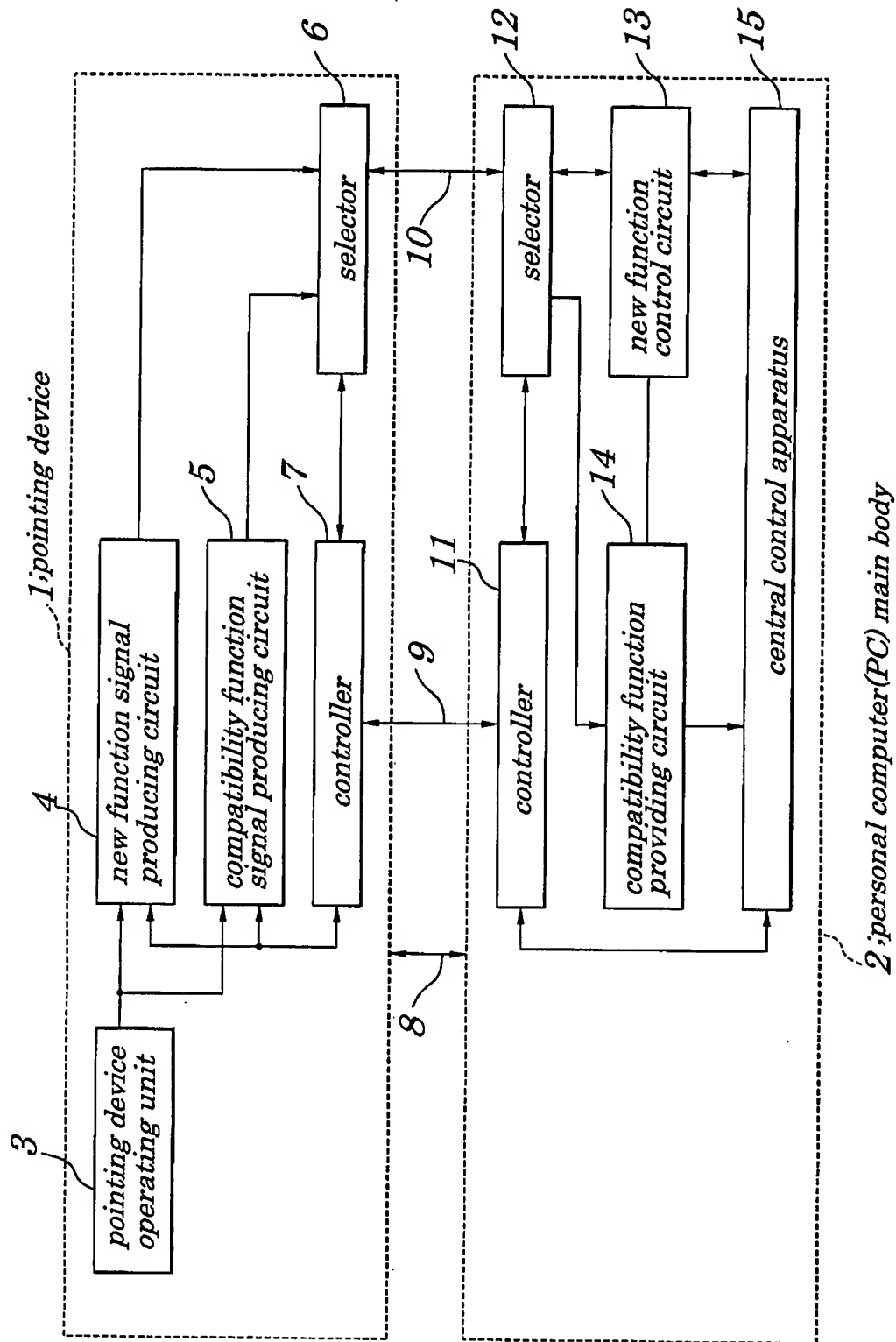
【Means to solve the problem】 When a personal computer main body 2 is turned ON, a compatibility function providing circuit 14 is operated so as to bring said computer main body 2 into a waiting state. When a pointing device 1 having an additional function is connected to the personal computer main body 2 under the waiting state, a signal is fed to a pointing device operating unit 3, a compatibility function signal producing circuit 5, a selector 6, a selector 12, the compatibility function providing circuit 14, and a central control apparatus 15 in sequence, whereby both the pointing device 1 and the personal computer main body 2 are operated in an original compatibility mode. A protocol transmission/reception operation via a protocol selector signal 9 is carried out between a controller 7 and other controller 11 in order to check as to whether or not said additional function of said pointing device is usable. When both controllers 7, 11 confirm that said additional function can be used, operation modes of both said pointing device and said computer main body are switched into additional function modes.

【Representative Drawing】 Fig. 1



【Title of the Document】 Drawings
【FIG.1】

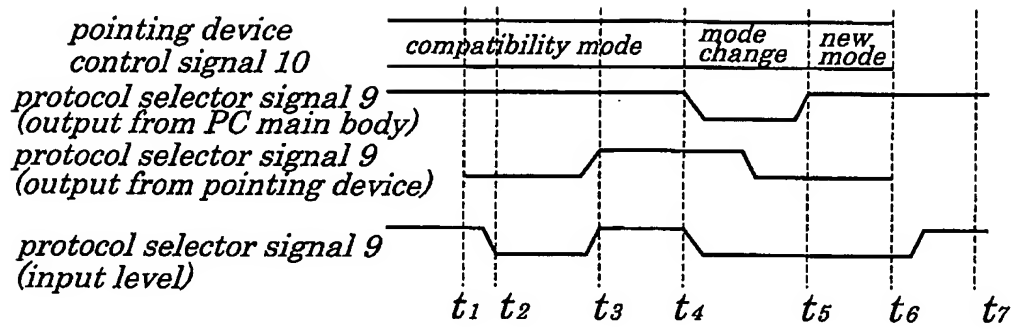
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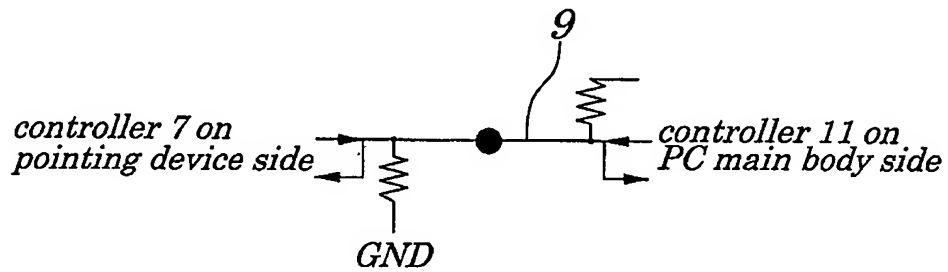


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【FIG.2】



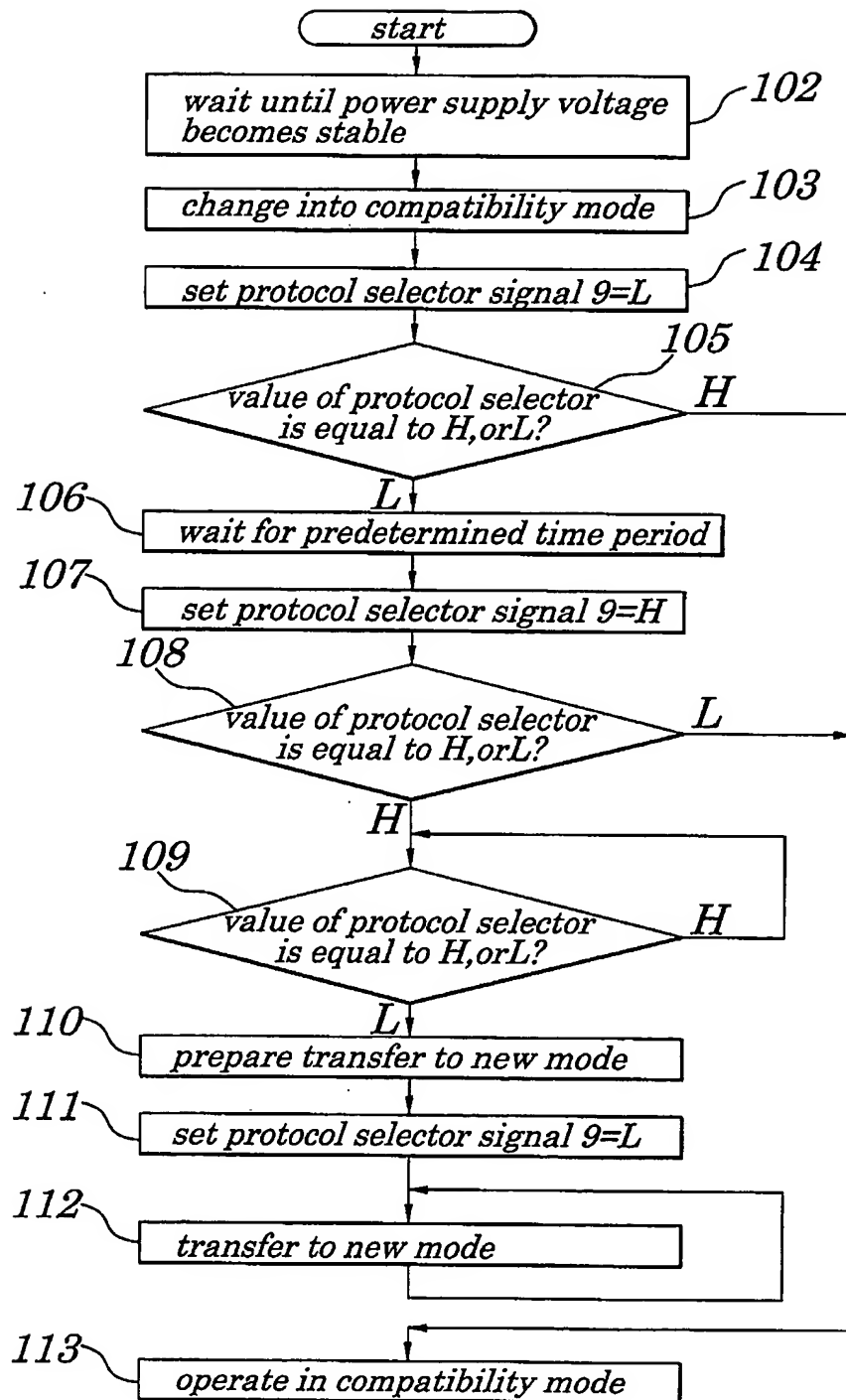
【FIG.3】





【FIG.4】

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【FIG.5】

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